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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/492,557	01/27/2000	Thomas C. Anthony	10990034-1	1020

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HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER

KIELIN, ERIK J

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 02/12/2002

15

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/492,557

Applicant(s)

ANTHONY, THOMAS C.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 23-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 23-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

Continued Prosecution Application

1. The request filed on 1/17/02 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/492,557 is acceptable and a CPA has been established. An action on the CPA follows.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims 23-27 are rejected under 35 U.S.C. 102(e) as being anticipated by **Hurst** et al. (US 5,956,267).

Hurst discloses an MRAM array wherein each memory cell includes the sense layer / tunnel layer / reference layer stack, 70, (Fig. 8, column 6, lines 27-42); the stabilizing structure “keeper” (30 in Figs 6-8; in the trench in Figs. 9-13 but not labeled; column 5, lines 27-47) formed of a magnetically permeable ferromagnetic material which (1) has a U-shape (Figs. 9-13) which runs along the wordline and therefore along plural memory cells (Abstract); (2) has a

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shape and proximity to the sense layer that provides flux closure: a path for magnetic flux transport between a pair of opposing edge regions of each sense layer; (3) inherently prevents disruptions to the magnetization state in each sense layer by specifically “directing demagnetization fields away from the edge regions;” and (4) applies a magnetic field to a set of edge regions which is **perpendicularly oriented** to the easy axis of each sense layer **in the absence of an electric current flowing** through the wordline. (See especially Fig. 16 which shows the magnetic flux **only while current is flowing** through the wordline; column 7, lines 6-15. See also Applicant’s specification, page 7, 1st paragraph which indicates that the magnetic field lines orient in the same manner as in **Hurst** when a current is flowing through the wordline.) If the magnetic field in the keeper 120 aligns as shown in Fig. 16, “[u]pon application of current in the wordline 120” (column 7, lines 9-10) it is clear that the alignment is **not** as shown in it. the absence of the current, which means it is “substantially perpendicular” as presently claimed in the instant application.

It is held, absent evidence to the contrary, that the keeper structure inherently prevents magnetic disruptions to the sense layer, i.e. which necessarily directs demagnetization fields away from a pair edge regions of each sense layer in the line because Applicant’s specification indicates that this is how. See In re Best, 195 USPQ 428 (CCPA 1977) and In re Fitzgerald, 205 USPQ 594 (CCPA 1980). In this regard, it is noted that **WO 00/42324** (based on US patent application 09/318,073 with *priority date 5/25/99* as provided in Applicant’s IDS of 5/15/01) assigned to the

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same assignee as the **Hurst** patent, **discloses that the keeper layer does indeed prevent magnetic disruptions to the sense layer** (page 15, lines 12-15).

Regarding claim 24, see Fig. 13, column 7, lines 32-47.

Regarding claim 25, see Figs. 15-16, column 7, lines 6-15; lines 33-47 -- especially lines 32-34).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hurst** in view of **Chen et al.** (US 5,748,524).

The prior art as explained above discloses all of the limitations of the claims except for (1) perhaps expressly stating that the easy axis of the stabilizing structure is substantially perpendicular to the easy axis of the sense layer; (2) forming the stabilizing structure from a hard ferromagnetic material (instant claims 31); or (3) indicating whether the reference or the sense layer is adjacent the keeper structure (instant claims 28, 29) and accordingly the sense layer is exchange coupled (instant claims 30 and 33).

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Chen discloses a MRAM cell comprising a sense layer/reference layer 21/23, 41/43, tunnel barrier 22, 42, and a stabilizing structure 30, 55 which is formed of a soft or hard ferromagnetic material with an easy axis [in the case of the soft magnetic material] or a magnetized axis [in the case of the hard magnetic material] oriented perpendicular to the easy axis of the sense layer; a shape that provides flux closure: a path for magnetic flux transport between a pair of opposing edge regions of the sense layer; and prevents disruptions (e.g. demagnetization fields) to the magnetization state in the sense layer 11. (See Figs. 5-8; columns 3-6.)

Regarding (1) and (2), **Chen** teaches the benefits of stabilizing the ends of the sense layer substantially perpendicular to the easy axis of the sense layer, by using either soft or hard ferromagnetic material which is ferromagnetically coupled, i.e. ferromagnetically exchange coupled to the ends of both the sense layer and the reference layer by virtue of direct contact therewith. (See column 4, lines 10-11, 41-44, and 58-63; column 6, lines 5-10. Compare to Applicant's specification, page 8, line 26 to page 9, line 4 and page 9, lines 18-24.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a hard ferromagnetic material to stabilize the end regions of the sense layer in a direction perpendicular to the easy axis of the sense layer and to use a hard ferromagnetic material as taught by **Chen** for the reasons indicated therein.

Regarding (3) given that both the reference and sense layers separated by the tunnel barrier are in the bit line 70 of **Hurst** (as indicated at column 6, lines 27-42), and that it is not indicated as to which of the permalloy layers is the reference and which is the sense, it is an

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obvious a matter of design choice as to which layer is closest to the keeper structure. Also given that the specification indicates that it doesn't matter which layer is closest to the keeper structure or that the layers may be exchange coupled or not to the keeper layer (page 8, lines 26-28 of the specification), the instant application provides no evidence of unexpected results for one orientation over the other.

It would have been obvious to one of ordinary skill in the art at the time the invention was made as a matter of design choice to have either the sense layer or the reference layer adjacent the keeper structure as the keeper structure would still serve the intended purpose in for either orientation.

Response to Arguments

6. Applicant's arguments filed 1/17/02 have been fully considered but they are not fully persuasive. The arguments have, however, overcome the 35 USC 102 rejections over the Lutes and Chen references.

Regarding Hurst, Applicant appears to argue that Hurst does not have sufficient "proximity" between the keeper structure and the sense layer end regions to affect the stabilization. Examiner respectfully, but expressly, disagrees. This would be contrary to the purpose of the keeper structure disclosed in Hurst making it inoperable. Furthermore, the Hurst Fig. 16 clearly shows the interaction between the magnetic fields that indicates the proximity

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exists. Exchange coupling is merely a matter of design choice since coupling works just as well.

And since Chen discloses ferromagnetic exchange coupling, the point is moot.

Further in this regard, Applicant has provided no evidence to traverse the inherency of the stabilization provided by Hurst -- especially in light of the reference assigned to the same assignees of the Hurst patent indicating that stabilization does in fact exist, as noted above.

Conclusion

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached at (703)306-2794 or by e-mail at olik.chaudhuri@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.


Erik Kielin

February 10, 2002